

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1 Claim 1 (original): A method for calibrating parameters of  
2 sensor elements in a sensor array, comprising:  
3 receiving an output signal of at least two sensor elements  
4 signal in reaction to an input signal from a signal source;  
5 estimating a cross-correlation between the output signals of  
6 at least two of said sensor elements;  
7 optimising a difference between the estimated  
8 cross-correlation and a cross-correlation model; and thereby  
9 estimating said parameters from the optimised difference;  
10 wherein a cross-correlation model is used as represented by  
11 the mathematical equation:

$$12 \quad R = G B G^H + D$$

13 in which equation:

14  $R$  represents a cross-correlation matrix,  
15  $G$  represent a gain matrix comprising gain parameters,  
16  $G^H$  represents the Hermitian conjugate of the gain matrix,  
17  $D$  represents a ((block) diagonal) noise matrix comprising  
18 noise parameters and  
19  $B$  represents a matrix comprising information about the  
20 signal source.

1 Claim 2 (original): A method as claimed in claim 1, wherein  
2 said difference is a least square difference.

1 Claim 3 (currently amended): A method as claimed in claim 1  
2 ~~or 2~~, wherein the cross-correlation is obtained by  
3 determining a time-averaged covariance matrix from the  
4 output signals.

1 Claim 4 (currently amended): A method as claimed in ~~any one~~  
2 ~~of the preceding claims~~ claim 1, wherein the sensor array is  
3 a single polarization or non-polarized sensor array.

1 Claim 5 (currently amended): A method as claimed in claim 1,  
2 wherein the sensor elements are dual polarization sensor  
3 elements for receiving a dual polarised signal.

1 Claim 6 (currently amended): A method as claimed in ~~any one~~  
2 ~~of the preceding claims~~ claim 1, wherein said method is  
3 performed for output signals of the sensor elements  
4 generated in reaction to input signals from at least three  
5 signal sources with different polarizations.

1 Claim 7 (original): A method as claimed in claim 4, wherein  
2 said optimising comprises:  
3 minimising a difference between a weighted logarithm of the  
4 estimated cross-correlation and a weighted logarithm of the  
5 cross-correlation and  
6 estimating the gain of at least one of the sensor elements  
7 from said difference.

1 Claim 8 (original): A method as claimed in claim 7, wherein  
2 the logarithm is weighted by a weighting matrix with matrix  
3 values relating to said gain parameters.

1 Claim 9 (currently amended): A method as claimed in ~~claims 7~~  
2 ~~or 8~~claim 7, wherein said optimising and said estimating  
3 gain parameters are performed at least a first time and a  
4 second time, wherein in the first time an uniform weight is  
5 used for all output signals and in the second time the  
6 weight is used in dependence on the gain estimated in the  
7 first time for the respective output signals.

1 Claim 10 (currently amended): A method as claimed in ~~any one~~  
2 ~~of claims 7-11~~claim 7, wherein said optimising comprises an  
3 operation as represented by the mathematical equation:  
4

5  $\{\mathbf{g}_{\text{est}}\} = \text{argmin}_{\mathbf{g}, \mathbf{k}} (\| \mathbf{W} \mathbf{J} \text{vec}(\ln(\mathbf{R}_{\text{est}}) - \ln(\mathbf{g} \mathbf{g}^H) + 2\pi \mathbf{k} i) \|_{\mathbf{F}})^2$   
6 , in which equation:

7  $\mathbf{g}_{\text{est}}$  represents the parameter to be estimated;

8  $\mathbf{g}$  represents a variable;

9  $\mathbf{g}^H$  represents the Hermitian conjugate of the variable;

10  $\mathbf{J}$  represent a selection matrix which puts zeros on the main  
11 diagonal;

12  $\mathbf{k}$  represents a phase unwrapping vector containing integer  
13 values;

14  $\mathbf{W}$  represents a weighting matrix; and

15  $\mathbf{R}_{\text{est}}$  represents the estimated cross-correlation.

1 Claim 11 (currently amended): A method as claimed in ~~any one~~  
2 ~~of the preceding claims~~claim 1, wherein the signal source is  
3 a satellite in orbit around a celestial body.

1 Claim 12 (currently amended): A method as claimed in ~~any one~~  
2 ~~of the preceding claims~~claim 1, wherein the signal source is  
3 a pulsar.

1 | Claim 13 (currently amended): A method as claimed in ~~any one~~  
2 | ~~of the preceding claims~~claim 1, wherein the output signals  
3 | have a low signal to noise ratio.

1 | Claim 14 (currently amended): A method as claimed in ~~any one~~  
2 | ~~of the preceding claims~~claim 1, wherein the sensor elements  
3 | are antennas in a phased array antenna.

1 | Claim 15 (currently amended): A method as claimed in ~~any one~~  
2 | ~~of the preceding claims~~claim 1, wherein the sensor elements  
3 | are electro-magnetic sensors elements.

1 | Claim 16 (currently amended): A method as claimed in ~~any one~~  
2 | ~~of the preceding claims~~claim 1, wherein the sensor elements  
3 | are acoustical sensor elements.

1 | Claim 17 (currently amended): A calibration system for  
2 | calibrating parameters of sensor elements in a sensor array,  
3 | , comprising  
4 | at least two inputs, each connectable to an output of an  
5 | sensor element in a sensor array;  
6 | a correlation estimator device for estimating a correlation  
7 | between the output signals of at least two of said sensor  
8 | elements  
9 | an optimiser device for optimising a difference between the  
10 | estimated cross-correlation and a cross-correlation model  
11 | and thereby estimating said parameters from the optimised  
12 | difference;  
13 | a memory device containing the cross-correlation model,  
14 | which model is represented by the mathematical equation:

$$R = G B G^H + D$$

16 | in which equation:

17 **R** represents a cross-correlation matrix,  
18 **G** represent a gain matrix comprising gain parameters,  
19 **G<sup>H</sup>** represents the Hermitian conjugate of the gain matrix,  
20 **D** represents a noise matrix comprising noise parameters and  
21 **B** represents a matrix comprising information about the  
22 signal source  
23 and-.

1 Claim 18 (currently amended): A calibration system as  
2 claimed in claim 17, wherein the sensor array is a dual  
3 polarised sensor array.

1 Claim 19 (original): A calibration system as claimed in  
2 claim 17, wherein the sensor array is a single polarization  
3 or non-polarized sensor array.

1 Claim 20 (currently amended): An array signal processing  
2 system calibrated with a method as claimed in ~~any one of~~  
3 ~~claims 1-17~~ claim 1.

1 Claim 21 (currently amended): A computer program product,  
2 comprising program code for performing steps of a method as  
3 claimed in ~~any one of claims 1-17~~ claim 1 when run on a  
4 programmable device.

1 Claim 22 (original): A data carrier comprising data  
2 representing a computer program product as claimed in  
3 claim 21.